Claims 1-4, 10-12 and 25-27 stand rejected under 35 U.S.C. 102(b) as being anticipated by Ludwig, U.S. Patent No. 3,675,935. Of these, claims 1, 10 and 25 are independent.

Claims 1 and 10 have been amended to more clearly recite the applicants' invention. Specifically, claims 1 and 10 have been amended to set forth that the hydropad is positioned to overlap an edge of the interface between the seal rings such that the hydropad is exposed to ambient low pressure air having a pressure substantially less than 14 psia and such that said hydropad pumps such low pressure air into said interface between said first seal ring and said second seal ring thereby substantially preventing penetration of said working fluid into said interface.

The combination of elements contained in independent claims 1 and 10 is not taught or suggested by Ludwig. First, Ludwig only refers to ambient air and not ambient low pressure air having a pressure substantially less than 14 psia as originally claimed in claims 1 and 10. Second, with reference to Ludwig Figs. 1 - 3, the hydropad of Ludwig is not positioned such that the hydropad overlaps an edge of the interface as now claimed in claims 1 and 10. Third, because Ludwig does not provide a hydropad that overlaps an edge of the interface, Ludwig does not teach that the hydropad pumps low pressure air into the interface between a first seal ring and a second seal ring thereby substantially preventing penetration of a working fluid into the interface as now claimed in claims 1 and 10.

In addition, Ludwig teaches a liquid-gas interface between the seat and the nose piece. (See column 2, lines 38-40, Fig. 1; column 2, lines 70-75 through column 3, lines 1-5, Figs. 1 and 2; and column 3, lines 48-64, Fig. 3.) Clearly, Ludwig does not teach an interface wherein the working fluid is substantially prevented from penetrating into the interface, as claimed in independent claims 1 and 10. In fact, Ludwig teaches that the pumping of the liquid, not low pressure air as claimed by the present invention, is what generates the seal between the seat and the nose piece. For example, as set forth in column 3, lines

1-5, "[w]hen the shaft 10 is rotated each groove 32 tends to pump liquid from its mating passage 46 at a faster rate than it is supplied. In this manner, the grooves 32 are only partially filled and a liquid interface 48 is formed in each groove 32."

Contrary to what is taught by Ludwig, the present invention does not rely on a liquid passing into the interface to be pumped back by the hydropads. The present invention provides a seal by pumping low pressure air into and across the sealing interface preventing any substantial penetration of the working fluid therein. Stated differently, since the hydropad is exposed to ambient low pressure air (by virtue of the hydropad overlapping an edge of the interface), when the shaft is rotated, the hydropads pump the low pressure air into the interface. To summarize, in Ludwig, it is the pumping of the liquid that separates the seals and creates the described seal arrangement, whereas, according to the claimed invention, it is the pumping of the low pressure air that separates the seals and creates the claimed sealing arrangement.

For each of the above-noted reasons, it is submitted that Ludwig does not anticipate claims 1 and 10, and withdrawal of the rejection is respectfully requested.

Furthermore, the invention defined in claims 1 and 10 would not be obvious to one skilled in the art. More specifically, It would not have been obvious to one skilled in the art that hydropad seals according to the present invention would even work in a low pressure environment. Prior to the subject invention, conventional thought was that exposing hydropads to ambient low pressure air having a pressure substantially less than 14 psia in order to attempt to create a seal between a housing and a shaft assembly would not work. In this regard, the Examiner's attention is directed to the Declarations of Mr. Flaherty, Mr. Packer, and Mr. Corrado, where they state, in essence, that they did not think the claimed design would work (i.e., would not prevent leakage of the working fluid and/or would not generate sufficient lift). Surprisingly, they determined that exposing

hydropads according to the present invention to ambient low pressure air does in fact work.

Accordingly, independent claims 1 and 10 define novel and nonobvious improvements over Ludwig and allowance of these claims is respectfully requested.

Additionally, dependent claims 2-4 and 11-12 depend directly or indirectly on amended independent claims 1 and 10 and should be allowable for the same reasons as applied thereto and for the additional subject matter recited in each.

With respect to independent claim 25, the claim requires a hydropad including a leading and a trailing edge, each edge being substantially straight and oblique to the radial direction of the first seal. Ludwig does not teach a straight leading edge nor does Ludwig teach a straight trailing edge. In fact, Ludwig teaches that the grooves 32 are spiral in nature. (See, e.g., column 2, lines 33 and 72; and column 3, lines 48-64, Fig. 4.) Spiral is certainly not the same nor is it equivalent to being substantially straight, as such is claimed in claim 25.

Accordingly, independent claim 25 defines novel and nonobvious improvements over Ludwig and should therefore be allowable. Claims 26 and 27 depend directly on claim 25 and should be allowable for the same reasons and for the additional subject matter recited in each.

Claims 6, 7, 14 and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ludwig '935.

First, claims 6, 7, 14 and 15 depend directly or indirectly on either independent claim 1 or claim 10 and should be allowable for the same reasons as set forth above.

Second, using a seal according to the present invention in situations where the seal is exposed to atmospheric pressures substantially less than 14 psia is not disclosed in the cited references and is not obvious to one skilled in the art. Again, the Examiner's attention is directed to the Declarations of Mr. Flaherty, Mr. Packer, and Mr. Corrado.

Hydropads such as those described in Ludwig are designed to create a seal upon being exposed to pressures generated by pumping liquid, not by being exposed to pressures generated by pumping low pressure air according to the present invention. The applicants determined that the illustrated hydropad is capable of pumping low pressure air to create a seal in an aerospace housing and shaft assembly to accomplish the features and advantages set forth in the Summary of the Invention.

Thus, claims 6, 7, 14 and 15 define nonobvious improvements over Ludwig and should be allowable.

Claims 8, 9, 16 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ludwig '935 in view of Nylykke, U.S. Patent No. 4,099,729.

Claims 8, 9, 16 and 17 depend directly or indirectly on either amended independent claim 1 or claim 10 and should be allowable for the same reasons applied thereto.

Claims 5 and 13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ludwig '935 in view of Takenaka, U.S. Patent No. 5,538,260.

First, claims 5 and 13 depend directly or indirectly on either amended independent claim 1 or claim 10 and should be allowable for the same reasons applied thereto.

Second, as previously set-forth, using a seal according to the present invention in situations where the seal is exposed to atmospheric pressures substantially less than 14 psia is not disclosed in the cited references. Takenaka describes atmospheric air, not air having a pressure substantially less than 14 psia as claimed according to the present invention.

Third, even if the atmospheric air of Takenaka is incorporated into Ludwig, Takenaka, like Ludwig, teaches that the pumping of liquid, not low pressure air, is what creates the seal. Specifically, column 4, lines 44-50, teaches "... the lubricant oil in the pressurized fluid passing through the clearance in the inner portion is caught by the fine grooves which are defined in such inner portion. The thus caught

lubricant oil is pushed back to the peripheral portion having no fine grooves owing to the pumping function of the fine grooves ..."

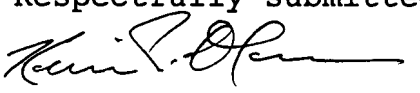
In addition, like Ludwig, the Takenaka grooves do not overlap the interface defined by the seal rings. Absent a disclosure of each and every limitation, the rejection must fail.

Therefore, claims 5 and 13 define nonobvious improvements over the combination of Ludwig and Takenaka and should be allowable.

New claims 28-30 depend directly on either claim 1 or claim 10 and should be allowable for the same reasons applied thereto and for the additional subject matter recited therein. Specifically, the art of record does not teach or suggest the claimed hydropad depths.

Allowance of the remaining pending claims is earnestly solicited.

Respectfully submitted,



Kevin P. Moran
Reg. No. 37,193

File No. 65112/9484 V3
Michael Best & Friedrich LLP
100 East Wisconsin Avenue
Milwaukee, WI 53202
(414) 271-6560

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